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Observations on the Parasitoids of *Mesepiola specca* Davis (Lepidoptera: Incurvariidae)

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Abstract.—Six species of hymenopterans were found parasitizing the moth, *Mesepiola specca* Davis, that feeds on *Nolina parryi* seeds at Pinyon Flat, California. Two species are endoparasitic and may be specific to *Mesepiola.* The other four species are ectoparasitic and are likely generalist parasitoids. The collected data suggest that one or two species of the ectoparasitoids dominate this parasitoid guild.

Mesepiola specca Davis is a small moth whose larvae bore into and feed only, so far as known, on the seeds of *Nolina parryi, N. microcarpa* and *Dasylirion wheeleri* in Arizona, New Mexico and California. Davis (1967) described the adult and Frack (1982) described the larva and pupa. Frack observed the adults to be active for perhaps 2 hr around dusk during the period in May when *Nolina* is blooming, sometimes congregating by the thousands around the flowers to mate and oviposit in the ovaries of the host.

Frack (1982) found that each larva feeds on and eventually destroys a maturing seed of the host plant. The full-grown larvae vacate the seed capsule by the end of June or early July and lower themselves to the ground by means of a silken thread. They overwinter in a tough cocoon in the soil, pupate, and emerge as adults, perhaps only during those years when *Nolina* blooms. The plant, at least in the area studied (Pinyon Flat, ca. 20 km SW of Palm Desert, Riverside County, California), blooms sporadically; in recent years there was extremely sparse or no blooming during 1983, 1985, 1986 and 1988 and much blooming during 1984 and 1987. Apparently the insects are capable of spending several years in the soil before emerging as adults.

This report gives a brief description of the behavior and activities of the hymenopterans that parasitize *Mesepiola* at Pinyon Flat.

METHODS

Parasitoids were collected both in 1984 and 1987. Two collecting methods were employed: (1) parasitoids observed on *Nolina* flowers and seed pods were aspirated into a vial and preserved in alcohol, (2) seed pods were collected shortly before the seeds and moth larvae were fully grown, and the adults of certain parasitoid species were reared from the pods during the following 3 or 4 wk. Still other species overwinter in the soil with the moth larvae, and so a variation of the second method allowed the moth larvae from the collected seed pods to vacate the pods and burrow into soil inside screened cages in the laboratory where they

overwintered. These parasitoids emerged at the time of adult moth eclosion the following spring and were collected and preserved.

Samples of *Nolina* seed pods were examined at various times during the springs of 1984 and 1987 to observe the percentage of seeds infested with *Mesepiola* larvae and the percentage of these larvae parasitized. Larvae were scrutinized externally for ectoparasitoids and then dissected to observe endoparasitoids.

The Parasitoid Guild

Six species of parasitoids were reared from *Mesepiola*:

Ichneumonidae
  Pristomermus inaequidens Dasch
Braconidae
  Pelicope yuccamica Mason
Eurytomidae
  Eurytoma sp. near *tylodermatis* Ashmead
Pteromalidae
  Zatropis tortricidis Crawford
  Mesopolobus sp.
Eulophidae
  Tetrastichus sp.

All of the above and two additional Braconidae (an undetermined species of *Apanteles* and another of *Habrobracon*) were also collected on *Nolina* flowers and/or seed pods. The latter two braconids were collected only on flowers and may have been attracted to them without necessarily being parasitic on the moth.

The braconid, *Pelicope yuccamica,* is an endoparasitoid that appears to parasitize only the egg stage of *Mesepiola,* or perhaps both the egg and very early larval stages. Adults of this parasitoid appeared in abundance at the time the moths were ovipositing (middle of May) in both 1984 and 1987, and disappeared by early June. No eggs of this species were ever observed in the larval moth dissections, but larvae of the parasitoid were found.

The ichneumonid, *Pristomermus inaequidens,* is also an endoparasitoid that prefers parasitizing younger *Mesepiola* larvae, although it is possible that this species will also parasitize moth eggs. Adults began to appear by mid-May, but were not really abundant until nearly the end of May, and pretty much disappeared by the third week of June. Both *Pelicope* and *Pristomermus* overwinter in the ground, carried there by the full-grown moth larvae which they parasitize. They kill their host sometime during this underground period and emerge as adults probably about the same time the moth adults emerge.

The remaining parasitoids are all chalcids (superfamily Chalcidoidea), and are ectoparasitoids that do not overwinter in the soil with the host larvae, but emerge from the seed pods as soon as the wasps are mature. Only one of these chalcids, *Zatropis tortricidis,* was identifiable. According to E. E. Grissell (pers. comm.), this species is widespread across the United States including California. It appears to be a "generalist" parasitoid but has few recognized hosts. *Eurytoma* sp. has been placed by Grissell close to *E. tylodermatis,* which is also a widespread polyphagous parasitoid but not well understood. *E. tylodermatis* has not yet been reported from California. *Mesopolobus* sp. and *Tetrastichus* sp. are members of

Table 1. Numbers and percentages of each species of parasitoid reared from *Nolina* seed pods.

Species	# emerged in 1984		Total	% of total	# emerged in 1987		Total
	♂	♀			♂	♀	
Pristomermus	105	84	189	14.3	—	—	—
Pelicope	3	3	6	0.5	—	—	—
Eurytoma	270	357	627	47.5	1425	1977	3402
Zatropis	0	2	2	0.2	6	14	20
Mesopolobus	0	0	0	0	0	3	3
Tetrastichus	142	355	497	37.5	77	262	339
				100			

groups which are in taxonomic turmoil and are completely unidentifiable (E. E. Grissell and M. E. Schauff, pers. comm.).

All of these chalcids are attracted to *Nolina* seed pods of variable ages, which indicates that they parasitize *Mesepiola* larvae also of various ages. *Zatropis* was rarely collected in the field at Pinyon Flat, but single specimens were taken several times in early and mid-June. *Eurytoma* appeared first in late May and became abundant by the second week of June. This species remained abundant until the *Mesepiola* larvae vacated the pods and entered the soil late in June and early July. Both *Mesopolobus* and *Tetrastichus* were uncommonly collected, but appeared to be present throughout the time when host larvae of various ages were available in seed pods.

Rearing and Host Dissection Results

Table 1 shows the actual numbers of parasitoids of each species that emerged from seed pod material collected and brought into the laboratory for rearing. (Much more material was collected in 1987 than in 1984.) These numbers give an indication of the relative amount of parasitization by each species. The percent parasitization of the host population cannot be calculated from these data since there was no way to count host numbers collected; however, this statistic can be estimated from data presented later. The numbers of *Pristomermus* and *Pelicope* reared in 1987 are not available since there was almost no emergence of these two species (or the moth adults) after overwintering in the laboratory. This difference in rearing success from the 1984 material may have been in the way the material was handled. The 1984 seed pods were cold-treated at 4.4°C for 8 wk during the winter, whereas the 1987 material was not. Without these data, the proportion of the total parasitization that each species represents could not be calculated for 1987.

Table 1 indicates that *Eurytoma* is the most numerous parasitoid in the guild. *Tetrastichus* was somewhat less important than *Eurytoma* in 1984; however, the 1987 data suggest that *Tetrastichus* was proportionally much less prevalent that year than in 1984. Numbers of *Pelicope, Zatropis* and *Mesopolobus* reared were insignificant at Pinyon Flat. However, samples of *Nolina* seed pods brought to me in 1984 by David Bramlet (a former graduate student) from two locations in the Santa Ana Mountains in Orange County, contained nothing but *Zatropis tortricidis*. So there may be great differences in the composition of parasitoid guilds attacking *Mesepiola* at different locations.

Observing the contents of *Nolina* seed pods showed that 57% of 374 seeds were infested with *Mesepiola* larvae in 1984, and 53% of 464 seeds were infested in 1987. By observing and dissecting *Mesepiola* larvae from these seeds, I found that 71% were parasitized in 1984, while only 46% were parasitized in 1987. As would be expected, this higher rate of parasitization in 1984 also resulted in a much higher rate of multiple parasitization. Of the moth larvae that were parasitized in 1984, 28% were multiple parasitized; in 1987, only 2% were. The dissections further indicated that only *Pristomermus* survived in a host which also contained *Pelicope,* so the ichneumonid endoparasitoid prevailed over the braconid. Neither of these two survived multiple parasitization by the ectoparasitic chalcids.

Discussion

Perhaps the most enigmatic aspect of this host–parasitoid system is the manner in which *Mesepiola* and its parasitoids handle the sporadic production of seeds by *Nolina.* It is not known whether a portion of the moth population emerges each year on the chance that *Nolina* will be blooming, or whether there is some mechanism which allows emergence only during those years when *Nolina* actually blooms. Likewise, it is not known how closely synchronized the emergence of the endoparasitoids (*Pristomermus* and *Pelicope*) is with the emergence of the moth, and whether there may be alternate hosts for these parasitoids at Pinyon Flat. In laboratory studies where the moth host and both parasitoids overwintered in pans of soil, all of the insects emerged about the same time the following spring. Neither *Pristomermus* nor *Pelicope* has been reared from any other host and both have been collected only from Riverside County (R. W. Carlson and P. M. Marsh, pers. comm.), so they may be specific to *Mesepiola* and well synchronized to the moth's life cycle.

The chalcids, on the other hand, more likely have alternate hosts to depend upon. Although virtually nothing is known about them, I suspect these chalcids are multivoltine, generalist parasitoids. There are abundant endophytic insects (gall formers, other seed pod dwellers, etc.) which they could parasitize in the Pinyon-Juniper Woodland habitat at Pinyon Flat. The evidence suggests that this host–parasitoid system is dominated by one or two species of these chalcids. Askew (1975) and Hawkins and Goeden (1984) have observed the domination by multivoltine, generalist parasitoids in cynipid galls on oaks, and cecidomyid galls on *Atriplex,* respectively. It seems reasonable that the same kind of situation may occur in other endophytic host–parasitoid systems such as those that infest seed pods.

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